**Ch8) example**

1. Samples of student height
2. Hypothesis test  
   significance level = 0.01  
   Null hypothesis: mu\_0 = 170  
   Alternative hypothesis: mu\_0 != 170  
   mu\_0 = 170  
   sample size(n) = 50  
   sample mean(x\_bar) = 172.9  
   sample st.dev(s) = 4.63291  
     
   t-statistic(t) = (x\_bar – mu\_0)\*SQRT(n)/s = 4.35459  
   p-value = 2\*P(X > t) = 6.77968E-05  
   p-value < 0.01, so Null hypothesis should be rejected.
3. Two-sided 99% confidence interval  
   alpha = 0.01  
   t\_0.005,49 = 2.679951974  
   Lower bound = x\_bar – (t\_0.005,49 \* s)/sqrt(n) = 171.0972118  
   Upper bound = x\_bar + (t\_0.005,49 \* s)/sqrt(n) = 174.6089802  
   confidence interval: (171.097, 174.609)
4. Polymer compound
5. Hypothesis test  
   significance level: 0.01  
   Null hypothesis: mu\_0 <= 3.5  
   Alternative hypothesis: mu\_0 > 3.5  
   mu\_0 = 3.5  
     
   sample size(n) = 8  
   sample mean(x\_bar) = 3.66875  
   sample st.dev(s) = 0.253119819  
     
   t-statistic = (x\_bar – mu\_0)\*sqrt(n)/s = 1.885656678  
   p-value = P(X > t) = 0.05066  
   p-value > 0.01, so null hypothesis should be accepted
6. One-sided 99% confidence interval  
   alpha = 0.01  
   t\_0.01,7 = 2.997951567  
   lower bound = x\_bar – (t\_0.01,7 \* s)/sqrt(n) = 3.400459206  
   confidence interval: (3.400459206, infinite)

**Ch9) example**

1. Paired
2. Hypothesis test  
   Null hypothesis: mu\_a – mu\_b = 0  
   Alternative hypothesis: mu\_a – mu\_b != 0  
     
   sample size(n) = 96  
   sample mean(z\_bar) = -1.895833333  
   sample st.dev(s) = 4.390130478  
     
   t-statistic = (z\_bar – 0)\*sqrt(n)/s = -4.231149236  
   p-value = 2\* P(Z > |t|) = 5.35872E-05  
   p-value < 0.01, so Null hypothesis should be rejected
3. 99% confidence level  
   alpha: 0.01  
   t\_0.005,95 = 2.628575671  
   Lower bound = -3.073608235  
   Upper bound = -0.718058431  
   confidence interval = (-3.0736, -0.7181)
4. Independent data(Unpooled, Compare the thickness between paints A and B)

* Sample size of A(n) = 75  
  sample size of B(m) = 82  
  sample mean of A(x\_bar) = 0.232  
  sample mean of B(y\_bar) = 0.201  
  sample st.dev of A(s\_x) = 0.070159796  
  sample st.dev of B(s\_y) = 0.080144523

1. hypothesis test  
   Null hypothesis: mu\_A = mu\_B  
   Alternative hypothesis: mu\_A != mu\_B  
     
   \*\*sample error(s.e.) = sqrt(s\_x^2/n + s\_y^2/m) = 0.011998458  
   \*\*mu\_hat = x\_bar – y\_bar = 0.0308743067058485  
     
   t-statistic = (mu\_hat – 0)/s.e = 2.573189582  
   \*\*degree of freedom(nju) = s.e^4/(s\_x^4/n/(n-1)+s\_y^4/m/(m-1))= 154.7126928  
   round down -> 154  
   p-value = 2\*P(X > |t|) = 0.011020714

if alpha = 0.01, p-value >0.01 and null hypothesis should be accepted.

1. 99% confidence interval  
   alpha = 0.01  
   t\_0.005,154 = 2.608130807  
   Lower bound = mu\_hat – t\_0.005,154\*s.e = -0.000419241  
   Upper bound = mu\_hat + t\_0.005,154\*s.e = 0.062167854  
   confidence interval = (-0.0004, 0.06217)  
   it is likely that paint A is thicker than paint B, but may be same.
2. Independent data(Pooled, Compare the thickness between paints A and B)

* Sample size of A(n) = 75  
  sample size of B(m) = 77  
  sample mean of A(x\_bar) = 0.232  
  sample mean of B(y\_bar) = 0.202  
  sample st.dev of A(s\_x) = 0.070159796  
  sample st.dev of B(s\_y) = 0.080144523  
    
  s\_p = sqrt((n-1)\*s\_x^2+(m-1)\*s\_y^2)/(n+m-2)) = 0.075384188  
  sample error(s.e) = s\_p\*(1/n+1/m) = 0.012229989

1. Hypothesis test  
   Null hypothesis: mu\_A = mu\_B  
   Alternative hypothesis: mu\_A != mu\_B  
   mu\_hat = x\_bar – y\_bar = 0.0298009854049227  
   \*\*t-statistic = (mu\_hat – 0)/s.e = 2.436714044  
   \*\*degree of freedom(nju) = n+m-2 = 150  
   p-value = 2\*P(X > |t|) = 0.015991975  
   if significance level(alpha) = 0.01, p-value > 0.01 and null hypothesis should be accepted
2. 99% confidence interval  
   alpha = 0.01  
   t\_0.005,150 = 2.609002566  
   Lower bound = -0.002107087  
   Upper bound = 0.061709058  
   confidence interval = (-0.0021, 0.0617)  
   it is likely that paint A is thicker than paint B, but may be the same

**Ch10) example**

1. In trials of a medical screening test for particular illness(Polulation proportion)
2. Hypothesis test  
   Null hypothesis p >= 0.1  
   Alternative hypothesis: p < 0.1  
   alpha = 0.01  
     
   p\_0 = 0.1  
   sample size(n) = 324  
   x = 23  
   p\_hat = x/n = 0.070987654  
     
   z-statistics = (p\_hat – p\_0)/sqrt(p\_0\*(1-p\_0)/n) = -1.740740741  
   p-value = P(X < z) = 0.040864517  
   p-value > alpha(0,01), so null hypothesis should be accepted
3. With continuity correction  
   x-n\*p\_0 = -9.4  
   z-statistics = (x-n\*p\_0+0.5)/sqrt(n\*p\_0(1-p\_0)) = -1.648148148  
   p-value = P(X < z) = 0.049661137  
   p-value > alpha(0,01), so null hypothesis should be accepted
4. 99% one-sided confidence interval  
   z\_0.01 = -2.326347874  
   Lower bound = p\_hat + z\_0.01\*sqrt(p\_0\*(1-p\_0)/n) = 0.109760119   
   confidence interval = (0,0.109760119)
5. 250 patients was split two groups of 125 patients(compare two population proportions)  
     
   Null hypothesis: p\_A = p\_B  
   Alternative hypothesis: p\_A != p\_B  
     
   group A  
   n = 125  
   x = 72  
   p\_a\_hat = x/n = 0.576  
     
   group B  
   m = 125  
   y = 60  
   p\_b\_hat = y/m = 0.48  
     
   Pooled  
   p\_hat = (x+y)/(n+m)  
   z = (p\_a\_hat – p\_b\_hat)/sqrt(p\_hat\*(1-p\_hat)\*(1/n+1/m)) = 1.520278946  
   p-value = 2\*P(X > |z|) = 0.128440883 <- norm.s.dist(-z,TRUE)임 조심